



TRANSPORTATION ADVISORY COMMITTEE

Arlington Planning Department, 730 Mass Ave,
Arlington MA, c/o Laura Wiener

To: Arlington Board of Selectmen, Arlington, MA

From: Transportation Advisory Committee (TAC)

Subject: Intersection of Mass Avenue/Mill Street/Jason Street

Date: May 9, 2013

The Special Permit for the new CVS store on Massachusetts Avenue provided funds to improve the above intersection if the funds are committed by October 19, 2015. As indicated in the attached report, this intersection has safety and operations issues and needs improvements.

The TAC has studied this intersection, and the study suggests that the following recommendations would significantly improve overall safety and operations as described in the attached report. The TAC voted the following recommendations unanimously on February 13, 2013:

1. Modify Mill Street southbound to have an exclusive left turn lane and a shared through/right turn lane.
2. Modify Jason Street northbound to have an exclusive right turn lane and a shared left/through lane.
3. Add a new signal controller with split signal phasing so that traffic from Mill Street and Jason Street runs separately with no conflicts.
4. Provide a 3-second advance for pedestrians crossing Mass Avenue concurrent with vehicles turning right from Jason Street and Mill Street.
5. Provide pedestrian countdown timers and audible alerts for pedestrian crossings.
6. Slightly reduce the width of the Jason Street traffic island to accommodate two northbound approach lanes.
7. Provide a bi-modal green/yellow left arrow for the Mass Avenue eastbound approach.
8. Coordinate with business owners on Mill Street to discuss prohibiting on-street parking during peak weekday periods to accommodate vehicle queuing.

The recommendations were endorsed by the ARB on March 18, 2013.

Respectfully submitted:

Jeff Maxtutis, Working Group Lead and Co-chair of the TAC

Transportation Advisory Committee Members:

Elisabeth Carr-Jones, Wayne Chouinard, Jean Clark, Paul Kent, Jeff Maxtutis, Howard Muise,
Officer Corey Rateau, Scott Smith, Edward Starr, Richard Turcotte, and Laura Wiener

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RECOMMENDATIONS FOR IMPROVEMENTS AT MASSACHUSETTS AVENUE/MILL STREET/JASON STREET

1. ISSUE STATEMENT

The intersection of Massachusetts Avenue (Mass Ave) with Mill Street and Jason Street currently experiences safety and operational issues that impact motorists, pedestrians and bicyclists.

- The crash rate exceeds the MassDOT average rate both statewide and for District 4.
- Historically, this intersection has experienced the 3rd highest number of crashes in town over a 10-year period.
- During peak AM hours, the vehicle queues on Mill Street can extend from Mass Ave to Summer Street, and back up onto Summer Street, causing dangerous congestion before the opening of the High School.

The off-set geometry of the side streets (Mill and Jason) combined with the concurrent signal phasing of these streets creates an unsafe situation for motorists turning through the intersection.

In addition, the existing all-red pedestrian phase (21 seconds) does not meet the current (2009) Manual on Uniform Traffic Control Devices standard of 29 seconds.

The TAC has evaluated alternatives and developed recommendations to improve safety and operations at this intersection.

2. EXISTING CONDITIONS

Geometrics and Signal Conditions

The following is a summary of geometric and signal conditions at the study intersection:

- Mass Ave has two general approach lanes and a parking lane in each direction
- Mill Street has two general southbound approach lanes. The inside lane is often used as an exclusive left-turn lane. The approach and departure lanes are divided by a small landscaped median with pedestrian refuge. On-street parking on the west side of the road is provided north of the intersection (in front of the Holovak & Coughlin sporting goods store). The MBTA Route 67 bus has a northbound stop on Mill Street south of Bacon Street and a southbound stop north of Millbrook Drive.

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- Jason Street has one wide general northbound approach lane. The approach and departure lanes are separated by a landscaped median with pedestrian refuge. Through and right-turning vehicles can sometimes pass around a vehicle waiting to make a left turn.
- Mill Street and Jason Street are off-set from one another causing difficulty and confusion for left-turning vehicles
- Pedestrian crosswalks are provided on each approach and handicap ramps are provided on each corner
- The intersection operates under the following signal phasing:
 - Phase 1 Eastbound Mass Ave advance phase with left-turn indication (9 seconds)
 - Phase 2 Eastbound and westbound Mass Ave
 - Phase 3 Exclusive pedestrian phase when called (all traffic stops)
 - Phase 4 Southbound Mill Street and northbound Jason Street
- The existing pedestrian all-red phase (21 seconds) does not meet current (2009) Manual on Uniform Traffic Control Devices standards (29 seconds). Signal pre-emption for emergency vehicles was added to this intersection in 2012.

Traffic and Pedestrian Volumes

Recent (2010) traffic volume counts were collected as part of the traffic impact studies for the CVS store and the Brigham's redevelopment. The following summarizes the existing AM and PM peak hour approach volumes:

	<u>AM Peak Hour</u>	<u>PM Peak Hour</u>
Mass Ave EB	672	951
Mass Ave WB	702	762
Jason Street NB	255	508
Mill Street SB	<u>641</u>	<u>403</u>
TOTALS	2,270	2,624

Intersection volumes are generally higher in the PM peak hour. However, because of the limited queue storage, the higher volumes on Mill Street in the AM peak hour cause excessive queuing. The Existing traffic volumes in the study area are provided in the Appendix.

Pedestrian volumes were counted at the study intersection during the AM and PM peak hours by TAC in November 2012. Approximately 100 pedestrians crossed the intersection in both the AM and PM peak hours. About one half of the pedestrians crossed Mill Street on the north side of Mass Ave, between 20 and 30 pedestrians crossed Jason Street on the south side of Mass Ave, and the remaining 20-25 pedestrians crossed Mass Ave.

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Intersection Operations

The off-set geometry of Mill and Jason Streets creates a confusing and hazardous situation for left-turning vehicles in a tight intersection. It is not clear for motorists making left turns from either roadway which direction opposing vehicles are headed. Because of the off-set geometry, left-turning vehicles wait in the middle of the intersection until they can clear. These conditions result in uncertain and hence, unsafe operations for motorists.

Intersection capacity analysis was conducted for the study intersection for existing conditions for the AM and PM peak hours. Level of Service (LOS), vehicle delay, and queuing were evaluated. The traffic and pedestrian volumes, geometrics, and signal operations discussed above were used for this analysis. The analysis results were calibrated to existing operating conditions based on observations of queue lengths conducted by TAC. The following summarize the capacity analysis results:

- The intersection operates overall at LOS E in the AM peak hour and LOS F in the PM peak hour; LOS E and F are generally considered deficient conditions, but are often tolerated for short periods in congested areas.
- Most approaches and movements operate at LOS D, E or F in both peak hours;
- The Mill Street left-turn movement operates with long queues (over 600 ft) in the AM peak hour. This is a serious problem because Mill Street does not have much storage capacity for queues, much less than Mass Ave and Jason Street. On-street parking can exacerbate queuing by forcing vehicles into one lane;
- In the PM peak hour, Mass Ave in both directions and Jason Street also experience long queues, but there is sufficient storage capacity.

Complete results are provided in the Appendix.

Safety

A total of 26 crashes were reported to the Arlington Police Department at this intersection in the period from 2009 through June 2012 (7.4 accidents per year). Of the 26 crashes, about two-thirds were either turning movement crashes (10) or rear-end collisions (7), with the remaining crashes (9) unidentified. This crash history is typical of locations where the right of way is uncertain. Only five (19%) of the crashes involved injuries, which typically represent slower speed collisions. The Crash rate (0.83 crashes per million entering vehicles) exceeds the MassDOT Average Crash rate statewide (0.80) and for District 4 (0.77). Historically, this intersection has experienced the 3rd highest number of crashes in town.¹

¹ Crash "Hot Spots", Town of Arlington (1990-2001).

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3. FUTURE CONDITIONS

Traffic Volumes

Future year 2015 traffic volumes were developed as part of the Brigham's Traffic Impact Study and were used for this analysis. The future volumes include volumes generated by the Brigham's redevelopment project and general background growth.

The following summarizes the year 2015 future AM and PM peak hour approach volumes:

	<u>AM Peak Hour</u>	<u>PM Peak Hour</u>
Mass Ave EB	704	1,018
Mass Ave WB	731	816
Jason Street NB	274	554
Mill Street SB	<u>722</u>	<u>450</u>
TOTALS	2,431	2,838

The future 2015 peak hour volumes at the study intersection are approximately 8 percent higher than the existing peak hour volumes. The future year 2015 traffic volumes are shown in the Appendix.

Alternatives Analyses

The following alternatives were identified and evaluated for the future conditions:

- No- Build – Modified lane use and existing signal phasing/timing
- Build 1– Modified lane use, pedestrian crossing time of 29 seconds, and optimized timings
- Build 2 – Modified lane use, existing signal phasing, concurrent pedestrian phase, and optimized timings
- Build 3 – Modified lane use, exclusive pedestrian phase, separate phases for Mill and Jason streets, and optimized timings
- Build 4 - Modified lane use, concurrent pedestrian phase, separate phases for Mill and Jason streets, and optimized timings

It is noted that the required pedestrian crossing time of 29 seconds was used for all Build Alternatives.

Capacity analysis was performed for each alternative for AM and PM peak hours for the future conditions. Intersection LOS, delay, and queuing were calculated. The overall intersection delay and LOS results are summarized below. These analyses are also shown in the Appendix.

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	<u>AM Peak Hour</u>		<u>PM Peak Hour</u>	
	<u>Delay (sec)</u>	<u>LOS</u>	<u>Delay(sec)</u>	<u>LOS</u>
Existing	68	E	82	F
No-Build	101	F	>120	F
Build 1	105	F	>120	F
Build 2	35	C	44	D
Build 3	>120	F	>120	F
Build 4*	68	E	76	E

* Preferred

Alternative Build 1 was eliminated because safety would not be improved and traffic operations would deteriorate. Although the Build 2 Alternative shows the lowest overall delay, it was eliminated because of safety concerns. A combination of Mill and Jason Streets running together along with concurrent pedestrian crossings would reduce pedestrian safety. Build 3 was eliminated because, although safety would be increased, traffic delay and queuing would increase to unacceptable levels. Build 4 shows the best combination of safety and traffic operations and has been selected as the Preferred Alternative. The traffic delay and LOS are equal to or better than existing conditions with significantly improved safety.

The split phase operation for Mill and Jason Streets and concurrent pedestrian phasing with a 3-5second pedestrian advance has been successfully used at several busy intersections in Cambridge for many years.

The following additional measures for Build 4 were identified to improve safety and operations further:

- Signage and pavement markings to designate exclusive left-turn and shared through/right-turn lanes on the Mill Street approach;
- Signage and pavement markings designating exclusive right-turn and shared left/through lanes on the Jason Street approach;
- Reduce width of the Jason Street traffic island by 12-18" to better accommodate two northbound approach lanes. The island would still be wide enough for landscaping and to provide a pedestrian refuge;
- Provide a 3-second signal advance for pedestrians crossing Mass Avenue concurrent with vehicles turning right from Mill and Jason Streets;

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- Provide pedestrian countdown timers and local audible alerts for pedestrian crossings to aid the handicapped;
- Provide a new signal controller to replace the old current controller;
- Provide new bi-modal green/yellow left arrow for Mass Avenue eastbound to indicate to motorists that the protected phase is ending;
- Coordinate with business owners on Mill Street to discuss prohibiting on-street parking during peak weekday periods to accommodate vehicle queuing.
- Retain No Right Turn on Red sign restriction for all intersection approaches.

4. RECOMMENDATIONS

1. Modify Mill Street southbound to have an exclusive left turn lane and a shared through/right turn lane.
2. Modify Jason Street northbound to have an exclusive right turn lane and a shared left/through lane.
3. Add a new signal controller with split phasing so that the traffic from Mill Street and Jason Street run separately with no conflicts.
4. Provide a 3-second advance for pedestrians crossing Mass Avenue concurrently with vehicles turning right from Mill and Jason Streets.
5. Provide pedestrian countdown timers and local audible alerts for pedestrian crossings.
6. Slightly reduce the width of the Jason Street traffic island to accommodate two northbound approach lanes.
7. Provide a bi-modal green/yellow left arrow for Mass Avenue eastbound.
8. Coordinate with business owners on Mill Street to discuss prohibiting on-street parking during peak weekday periods to accommodate vehicle queuing.

The recommendations are shown in the attached figure.

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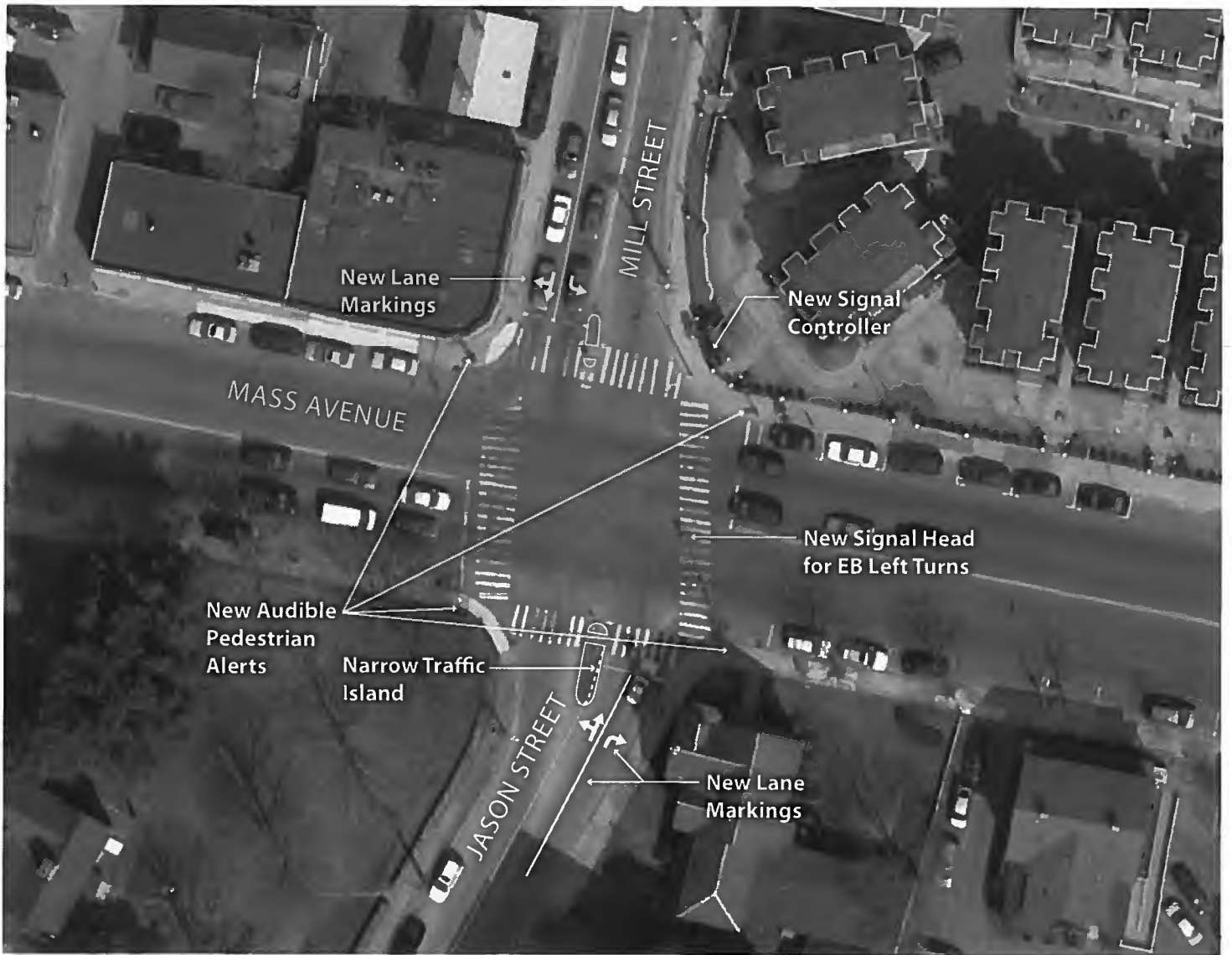
5. FUNDING

Signal pre-emption for emergency vehicles was added to this intersection in 2012. It was paid for (approximately \$8,000) with the mitigation funds identified for the CVS project. There is approximately \$42,000 remaining for improvements at the intersection. A preliminary cost estimate indicates that the remaining amount should be adequate to cover most, if not all, of the recommendations listed above, including engineering design. It is noted that if additional signal loop detectors are desired, this would be an additional cost.

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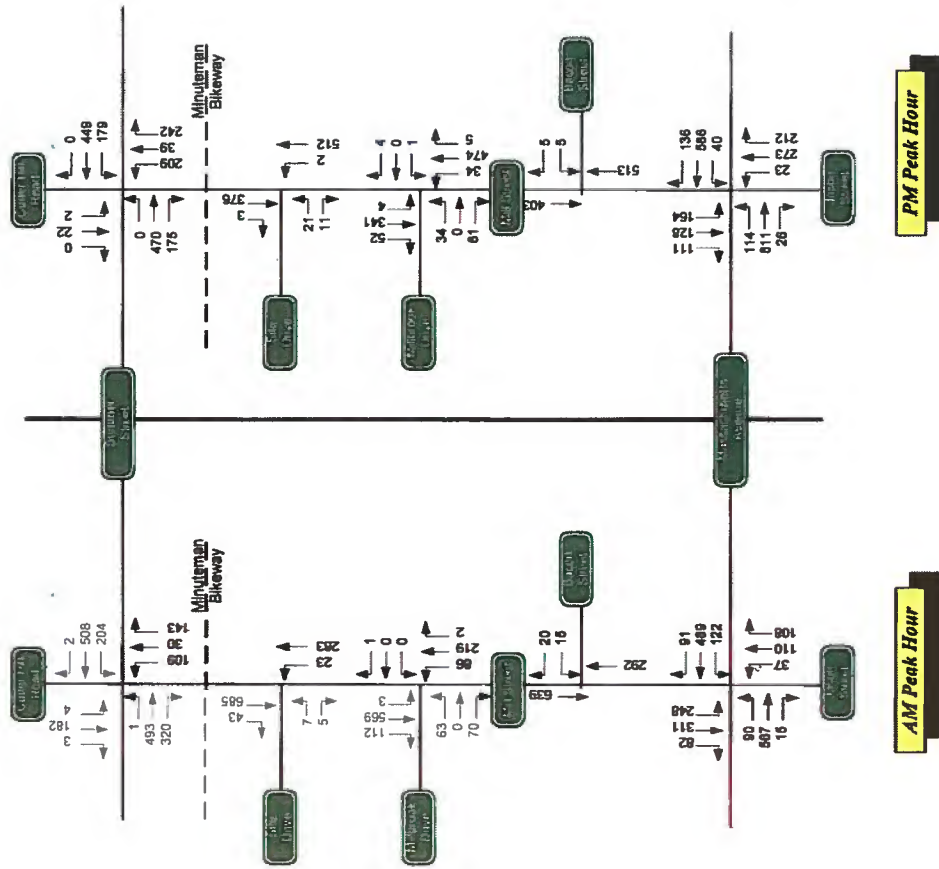


APPENDIX

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Massachusetts Avenue at Mill Street and Jason Street – Existing Conditions Analysis

	Existing AM Peak Hour				Existing PM Peak Hour			
	Ave. Delay	LOS	50 th % Queue	95 th % Queue	Ave. Delay	LOS	50 th % Queue	95 th % Queue
Massachusetts Ave EB LT/TR	41.1	D	234	260	112.9	F	396	574
Massachusetts Ave WB LT/TR	85.5	F	325	448	56.1	E	311	439
Jason Street NB LT	64.3	E	155	269	48.5	D	345	498
Jason Street NB R	33.8	C	50 ⁽¹⁾	50 ⁽¹⁾	41.9	D	50 ⁽¹⁾	50 ⁽¹⁾
Mill Street SB L	103.2	F	338	671	>120	F	186	328
Mill Street SB TR	79.0	E	220 ⁽²⁾	220 ⁽²⁾	43.0	D	187	220 ⁽²⁾
Overall Intersection	68.4	E	-	-	82.0	F	-	-

Abbreviations:

LT = Left
 EB = Eastbound
 WB = Westbound
 NB = Northbound
 SB = Southbound
 L = Left
 T = Through
 R = Right
 LT = Left & Through
 TR = Through & Right
 Ave. Delay = Average Delay per vehicle (seconds)
 LOS = Level of Service
 50th % Queue = 50th Percentile Queue (feet)
 95th % Queue = 95th Percentile Queue (feet)

⁽¹⁾ Queues in excess of 50 ft have been added to the Jason St left lane, as the right-turn lane queue storage is at capacity.

⁽²⁾ Queues in excess of 220 ft have been added to the Mill St left lane, as the through/right-turn lane queue storage is at capacity.

General Notes:

- Results are based on Synchro 8 analyses.
- Traffic volumes from *Traffic Impact and Access Study, Proposed Mill Street Residential & Retail Development, 30-50 Mill Street, Arlington, MA*, prepared by M5 Transportation Systems / New England Engineering Group, April 2010 and revised September 2010.
- Supplemental pedestrian volume data from November 29, 2012.
- The Mill Street SB approach has approximately 220 ft back from the stop bar to queue in two lanes.
- The Jason Street NB approach has approximately 40-50 ft back from the stop bar to queue in two lanes.

Massachusetts Avenue at Mill Street and Jason Street – Existing Conditions Queue Observations

	Existing AM Peak Hour				Existing PM Peak Hour			
	50 th % Queue	95 th % Queue	Num. of Vehicles	Feet	50 th % Queue	95 th % Queue	Num. of Vehicles	Feet
Jason Street NB	-	-	9	~180	-	-	17	~340
Mill Street SB	-	~290	-	~700	-	-	-	-

Notes:

- Jason Street queue observations are from November 29, 2012.
- Mill Street queue observations are from October 13, 2010 and October 20, 2010.

Massachusetts Avenue at Mill Street and Jason Street – Future Conditions Comparison – AM Peak Hour

	Future No-Build				Future Build Alt 1				Future Build Alt 2				Future Build Alt 3				Future Build Alt 4			
	Ave. Delay	LOS	50 th % Queue	95 th % Queue	Ave. Delay	LOS	50 th % Queue	95 th % Queue	Ave. Delay	LOS	50 th % Queue	95 th % Queue	Ave. Delay	LOS	50 th % Queue	95 th % Queue	Ave. Delay	LOS	50 th % Queue	95 th % Queue
Mass Ave EB LT/TR	52.0	D	250	290	86.1	F	371	420	21.4	C	162	186	110.6	F	418	468	50.0	D	316	335
Mass Ave WB LT/TR	109.4	F	357	483	>120	F	478	612	38.0	D	213	325	>120	F	504	638	70.2	E	402	549
Jason Street NB LT	>120	F	218	350	113.2	F	257	400	28.2	C	93	169	>120	F	345	538	82.5	F	276	377
Jason Street NB R	34.0	C	50 ⁽¹⁾	50 ⁽¹⁾	39.7	D	50 ⁽¹⁾	50 ⁽¹⁾	20.4	C	50 ⁽¹⁾	50 ⁽¹⁾	>120	F	50 ⁽¹⁾	50 ⁽¹⁾	72.1	E	50 ⁽¹⁾	50 ⁽¹⁾
Mill Street SB L	>120	F	506	838	>120	F	653	1,023	54.7	D	206	508	74.4	E	724	1,039	53.1	D	597	879
Mill Street SB TR	112.8	F	220 ⁽¹⁾	220 ⁽¹⁾	91.7	F	220 ⁽¹⁾	220 ⁽¹⁾	45.6	D	220 ⁽¹⁾	220 ⁽¹⁾	>120	F	220 ⁽¹⁾	220 ⁽¹⁾	98.9	F	220 ⁽¹⁾	220 ⁽¹⁾
Overall Intersection	100.7	F	-	-	104.6	F	-	-	34.6	C	-	-	>120	F	-	-	68.2	E	-	-

Abbreviations:

EB = Eastbound
WB = Westbound
NB = Northbound
SB = Southbound
LT = Left
T = Through
R = Right
LOS = Level of Service
Ave. Delay = Average Delay per vehicle (seconds)
50th % Queue = 50th Percentile Queue (feet)
95th % Queue = 95th Percentile Queue (feet)

⁽¹⁾ Queues in excess of 50 ft have been added to the Jason St left lane, as the right-turn lane queue storage is at capacity.

⁽²⁾ Queues in excess of 220 ft have been added to the Mill St left lane, as the through/right-turn lane queue storage is at capacity.

General Notes:

- Results are based on Synchro 8 analyses.
- Future Traffic volumes from Traffic Impact and Access Study, Proposed Mill Street Residential & Retail Development, 30-50 Mill Street, Arlington, MA, prepared by MS Transportation Systems / New England Engineering Group, April 2010 and revised September 2010.
- Supplemental pedestrian volume data from November 29, 2012.
- The Mill Street SB approach has approximately 220 ft back from the stop bar to queue in two lanes.
- The Jason Street NB approach has approximately 40-50 ft back from the stop bar to queue in two lanes.

Future Alternative Summary

Alternative	Description
Future No-Build	Future Volumes, Existing Signal Phasing & Timing
Future Build Alt 1	Future Volumes, Jason St & Mill St run together, exclusive ped phase, essentially existing phasing, with optimized signal timings.
Future Build Alt 2	Future Volumes, Jason St & Mill St run together, concurrent ped phase, and optimized signal timings.
Future Build Alt 3	Future Volumes, Jason St & Mill St have split phasing (run separately), exclusive ped phase, and optimized signal timings.
Future Build Alt 4	Future Volumes, Jason St & Mill St have split phasing (run separately), concurrent ped phase, and optimized signal timings.

Analysis Assumptions

- The pedestrian phase is increased in all build scenarios. The existing pedestrian phase timing is 21 seconds long, which includes 7 seconds for walk (W), and 14 seconds for flashing don't walk (FDW). To meet the 2009 MUTCD requirements, a minimum FDW time of 22 seconds is needed. Therefore, in all future build alternatives, a 29 second pedestrian phase is assumed, which includes 6 seconds of W, 22 seconds of FDW, and one second all-red.
- In all scenarios that have Jason Street and Mill Street running together (existing, future no-build, and future build alternatives 1 and 2), a reduced ideal saturation flow rate of 1700 vehicles per hour was used to calibrate the model due to friction that occurs due to the offset of the two roadways.
- In the two build alternatives that have Jason Street and Mill Street running separately with split phasing, the ideal saturation flow rate for Jason Street and Mill Street was changed to a typical value of 1900 vehicles per hour.

December 20, 2012

Massachusetts Avenue at Mill Street and Jason Street – Future Conditions Comparison – PM Peak Hour

	Future No-Build				Future Build Alt 1				Future Build Alt 2				Future Build Alt 3				Future Build Alt 4			
	Ave. Delay	LOS	50 th % Queue	95 th % Queue	Ave. Delay	LOS	50 th % Queue	95 th % Queue	Ave. Delay	LOS	50 th % Queue	95 th % Queue	Ave. Delay	LOS	50 th % Queue	95 th % Queue	Ave. Delay	LOS	50 th % Queue	95 th % Queue
Mass Ave EB LT/TR	>120	F	491	681	>120	F	770	910	52.4	D	179	325	>120	F	693	883	64.6	E	375	548
Mass Ave WB LT/TR	86.7	F	381	509	>120	F	536	672	28.6	C	178	280	97.2	F	498	634	35.2	D	340	424
Jason Street NB LT	76.8	E	406	624	64.5	E	522	698	30.5	C	185	317	>120	F	780	1,062	>120	F	605	857
Jason Street NB R	42.5	D	50 ⁽¹⁾	50 ⁽¹⁾	46.2	D	50 ⁽¹⁾	50 ⁽¹⁾	22.9	C	50 ⁽¹⁾	50 ⁽¹⁾	>120	F	50 ⁽¹⁾	50 ⁽¹⁾	80.1	F	50 ⁽¹⁾	50 ⁽¹⁾
Mill Street SB L	>120	F	263	434	>120	F	356	542	>120	F	119	216	>120	F	443	685	75.7	E	321	510
Mill Street SB TR	46.1	D	208	220 ⁽²⁾	48.9	D	220 ⁽²⁾	220 ⁽²⁾	24.6	C	109	166	>120	F	220 ⁽²⁾	220 ⁽²⁾	>120	F	220 ⁽²⁾	220 ⁽²⁾
Overall Intersection	>120	F	-	-	>120	F	-	-	43.5	D	-	-	>120	F	-	-	76.3	E	-	-

Abbreviations:

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- The pedestrian phase is increased in all build scenarios. The existing pedestrian phase timing is 21 seconds long, which includes 7 seconds for walk (W), and 14 seconds for flashing don't walk (FDW). To meet the 2009 MUTCD requirements, a minimum FDW time of 22 seconds is needed. Therefore, in all future build alternatives, a 29 second pedestrian phase is assumed, which includes 6 seconds of W, 22 seconds of FDW, and one second all-red.
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